2021 ASEE ANNUAL CONFERENCE
Virtual Meeting | July 26–29, 2021 | Pacific Daylight Time
Paper ID #33346

The International Engagement of Engineering Education in China: A Historical Case Study of Tsinghua University

Zheping Xie, Tsinghua University
Dr. Xiaofeng Tang, Tsinghua University

Xiaofeng Tang is Associate Professor in the Institute of Education at Tsinghua University. Prior to his current position, Dr. Tang worked as an Assistant Professor of Practice in the Department of Engineering Education at The Ohio State University. He did postdoctoral research in engineering ethics at Penn State University. He received his Ph.D. in Science and Technology Studies from Rensselaer Polytechnic Institute.

Prof. Fujun Jin

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Abstract: This paper examines the international engagement history of Tsinghua University, the leading institution of engineering education in China. We contend that the tradition of engineering education at Tsinghua resulted from learning from and cooperating with the west, grows with and impacted by domestic missions and international politics. The paper presents the history of engineering education in three phases, through which we aim to illustrate a scenario of how the international engagement influenced engineering education. This paper seeks to enrich and re-energize conversations toward an open and collaborative global community of engineering education at a time of uncertainty amid a global pandemic and rising geopolitical tensions.

Key Words: engineering education; Tsinghua University; international engagement

Introduction

"To find solutions to the complex problems of our world, we need all the brains we can muster." (Michele Thibodeau-DeGuire)

The current COVID-19 pandemic has placed further strain on engineering education (UNESCO, 2021), and has suspended cross-boarder mobility of higher education worldwide. Travel restrictions resulted from the pandemic as well as tensions between the United States and China seem to cast a shadow over the prospect of international exchange and collaboration in engineering education. However, university as a form of institutionalized higher learning has been, since its medieval genesis, fractured around a contradiction between nationalistic particularity and a commitment to more universalistic standards. (Turne 1998)

History shows that international engagement and collaboration is deeply rooted in the birth and growth of engineering education in China, and this orientation is very likely to sustain in the future. As China's leading institution of engineering education, the history of Tsinghua mirrors the story of higher education in modern China. As "international collaboration was in the DNA of Tsinghua University" (Kirby 2016) , the university's history over a century not only demonstrates how international engagement has shaped China's engineering education of the present day, it also proves the effectiveness of internationalization as a developmental approach for engineering education in China. This paper examines interactions between international partners and Tsinghua University in this historical context.

Phase One (1911-1949): Learning from and Cooperating with the West

The early years' quick development of engineering education at Tsinghua University – including its establishment, progress and striving during World War II – in important ways mirrored the early development of modern higher education in China. Tsinghua University was in 1911, the final year of China's last imperial dynasty. Founded by the Qing court as Tsinghua Xuetang (Tsinghua Academy) near the site of the Tsinghua yuan, an imperial garden built in the eighteenth century, Tsinghua began as a preparatory school for students selected to study in the United States. After the Republic of China – the first Republic in Asia – was founded in 1912, Tsinghua thrived together with the nascent Republic. By 1925, Tsinghua had become a college of liberal arts and sciences, with a department of engineering that offered a bachelor's degree. With the National Party competed its Northern expedition and finally united the young Republic and established the National Government in 1928, Tsinghua was transformed into National Tsing Hua University, and with a graduate school inaugurated in the following year (1929), and its School of Engineering founded in 1932. By 1935, Tsinghua had created ten graduate departments, accounting for one third of all the graduate departments in China at the time. By 1937, Tsinghua had become a comprehensive university and a leading institution of higher education in China, consisting of four schools – engineering, liberal art, science, and law, with 23 professors in engineering and 107 professors in total.

The origin of Tsinghua's engineering education drew heavily from the US, which was embodied in its faculty, research, and university leadership, and particularly in its adoption of the American research approach and curriculum system (Author 2018). The pioneering engineering educators at Tsinghua emulated the engineering curriculum and instructional methods from the US. Though the teaching was conducted in Chinese, major textbooks and reading materials provided to the students were written in English. Programs like electrical engineering and aviation engineering adapted relevant teaching plans from MIT –including a 4-year Bachelor's program and the use of a credit system. For the aircraft program, the general courses and most fundamental professional courses of aviation program were almost the same as the mechanical program. Of course, there are also a wide range of professional bases and less professional courses.(Cao 1999).

Based on the Sino-US agreement, Tsinghua started sending students to American universities since 1909 – before Tsinghua Academy was set up. From 1909 to 1929, Tsinghua sent 1,290 students to the United States, of whom 404 students chose engineering majors– the concentration on engineering was highly encouraged by the Chinese government, since China was in great desire to develop modern industry and believed firmly in "modernization equals to industrialization". This group of oversea students offered well educated human resource for China in the coming decades – including many of the early faculty members of Tsinghua in the 1920s and 1930s. Of the entire 104 Tsinghua faculty members in 1936, 23 were employed in the school of engineering, and most of them were returned Tsinghua alumni oversea. "In Civil Engineering, we had Professors C.Y. Shih, F.Y. Tsai, P K. Tao, M.C. Wang, M.C. Li, Jen Chang, T H. Chang, and others. In Mechanical Engineering, we had Professors Sien-chow Liu (formerly President of Pei Yang University), C T. Chang, T H. Li, T L. Yin, Paul Wang, S.C. Wang K L Feng, W.Y. Yin." (Ku, 2000) These returnee engineering faculty transplanted the American teaching method, textbook and credit systems to Tsinghua. Meanwhile, through academic connections established by these returnees, leading international professors were invited to teach and conduct research at Tsinghua. In many cases joint research was carried out by the visiting Americans together with the Chinese faculty.

Tsinghua's engineering collaboration with American institutions, particularly with MIT, was very intensive during this early phase of the university's history. Engineering education at Tsinghua began in 1926, when Tsinghua was transformed from a preparatory academy to a university aspiring to educating national leaders in science and engineering. The influence of MIT was highly visible in the establishment of Tsinghua's first college of engineering in 1932, with half of the engineering faculty and all three engineering department heads - Chia-Yang. Shih, C T. Chuang and Y. H. Ku , having graduated from MIT (Y.H. Ku was also the dean of the engineering college). From autumn 1935 to summer 1936, MIT mathematics professor Norbert Wiener worked as a research professor for departments of Mathematics and Electrical Engineering at Tsinghua through the invitation of the university President Y. C. Mei and the dean of engineering Y.H. Ku (Wei 2001). At the 10th International Congress of Mathematicians (Oslo, Norway) in 1936, Wiener published a paper about gap theory on behalf of both Tsinghua and MIT. Wiener had two papers published in the Chinese Journal of Electrical Engineering in 1935 and in 1936 respectively: *On Operational Calaculus* and *On the Kron Theory of Tensors in Electric Machinery*. In his published biography, Wiener cherished the year spent at Tsinghua as a very important time of his academic career.

> "If I were to take my specific boundary point in my career as a journey-man in science and as in some degree an independent master of the craft, I should pick 1935, the year of my China trip, as that point "(Wiener 1956)

The Department of Electrical Engineering and Applied Electronic Technology (EAA) was founded in 1932, with Y. H. Ku serving as the department head. An electrical engineering building was constructed in 1935, which was the most important engineering building on campus at the time. In Electrical Engineering, Tsinghua had Professors Tsin Nee (Head of Department), Yuk-Wing Lee (Sc D MIT), C.K. Jen (Ph. D, Harvard), MT. Chang (later Department Head), Y M. Chao, and others. (Ku, 2000) EAA also had academic contact with the UK via MT. Chang, one of the department heads who had been educated at Newcastle University. In 1938, when the Japanese army occupied Tsinghua campus, EAA faculty and students retreated with the entire university to southwest China (Kunming), yet most of the laboratory equipment was left behind. When the Department of EEA returned to Tsinghua campus in 1946, the Electrical Engineering Building remained intact, yet no laboratory equipment was preserved.

An option in Aeronautical Engineering was started by Professors S.C. Wang and K.L. Feng, while the origin of aeronautical engineering can be traced to Theodore von Kármán's first visit to Tsinghua in 1929, during which he made an unsuccessful pitch of the importance of aviation engineering to Tsinghua leadership. In 1932, aeronautical engineering was introduced to Tsinghua University as a part of the Dept. of Mechanical Engineering three inaugural research teams – power engineering, mechanical engineering, aeronautics and car engineering. The aeronautics and car engineering research team transformed into aviation research team two years later, making it the earliest aviation engineering program in China, with a focus on the manufacture, handling, testing and comparison of aircrafts. The Institute of Aviation Engineering Research, as well as the aviation building were both constructed in 1936. Tsinghua Aviation Engineering had close connection with the international community – the program's initial collection of journals and books were all shipped from Europe and USA. In the winter of 1935, F.L. Wattendorf arrived at Tsinghua as a chair professor for teaching and research, with Theodore von Kármán's strong recommendation –

by this time von Kármán had moved to Caltech and could not accept Tsinghua's invitation as Honorary Professor and advisor. (Author 2009) F.L. Wattendorf's remarkable work at Tsinghua included not only teaching and joint research, but also an international journal publication about Tsinghua's wind-tunnel. (Wattendorf 1938) The small scale Tsinghua wind-tunnel (with 5-fy throat diameter) was constructed during 1935, as China's first wind-tunnel, designed and completed by Tsinghua aviation faculty with S.C. WANG, a MIT graduate as the team leader. In cooperating with Chinese Air Force, Tsinghua developed a plan to build a 15-ft throat wind tunnel in the City of Nanchang - WANG and Wattendorf took the responsibility and made a progress report in early 1937. Theodore von Kármán visited Tsinghua once again in the summer of 1937, the very week when Japanese troops invaded Beijing, and left for China's capital Nanjing at the very eve of the War. Von Kármán and Dean Y. H. Ku inspected the planned wind-tunnel in southern China. However, the Tsinghua wind-tunnels were heavily bombed and damaged by the Japanese troops in the summer of 1937, in Beijing and Nanchang. Yet, S.C. WANG led his Tsinghua team to successfully rebuild the 5-fy throat diameter wind tunnel in Kunming in 1940. When aviation faculty returned to Tsinghua campus in 1946, they found the aviation building heavily damaged by the Japanese military. In 1952, during the re-organization of China's higher education system, the Dept. of Aviation Engineering of Tsinghua University - including Tsinghua's first female professor Shijia Lu, a student of Ludwig Prandtl at Georg-August-Universität Göttingen, was completely moved out to form the newly established Beihang University.

Before the Japanese invasion on July 7, 1937, "we had less than five years to develop a first rate Engineering College at Tsing Hua."(Ku, 2000) Even through the difficult war times, the engineering education of Tsinghua expanded from three departments -civil engineering, mechanical engineering and electrical engineering, to six departments – with the addition of aviation engineering, chemical engineering and constructing engineering – from 1937 to 1947. However, the Japanese invasion did disrupt China's fast development of industry and higher education in the 1930s, and the negative impact on China's engineering education was obvious. While Tsinghua's faculty and students retreated from Beijing to Changsha and then to Kunming with a difficult long-distance travel, most of the laboratory equipment, including the wind-tunnel, were all left on campus in Beijing. Much though life at Kunming was terribly challenging, the international collaboration was never stopped. During the most tough times of 1940s, Tsinghua kept sending engineering faculty and students to continue their study and research in the United States and Europe – including young talented Chen-Ning Franklin Yang and Tsung-Dao Lee, the Nobel laureates of physics in 1957.

Engineering education was crucial for China's industrial development through the supply of qualified engineers before and during the war. EEA admitted seven transferred sophomores and 31 freshmen in 1932, and graduated its first three student in 1935. EEA wielded great reputation at that time—as the most challenging department for students, while the Department of Civil Engineering the longest-serving one. Engineering graduates were rather crucial for the war against Japanese invasion. EEA Department opened the Institute of Electrical Engineering to recruit graduate students during the war time, ran the telecommunications training class with a two-year educational system in 1939, and educated a large number of telecommunication talents needed urgently during the War. The Aviation Department educated 126 graduates during the war time and hosted a test pilot training program for the Chinese military in 1940. Even the wind tunnel was reconstructed with strong support from the Chinese President, to offer emergent assistance for China Air Force. In addition, hundreds of Tsinghua engineering students joined the Chinese Army. Many of the war time engineering graduates of Tsinghua became academicians of Chinese Academy of Sciences, professors and senior experts. In 1946, the Department of EEA admitted more than 100 freshmen all over China – including Zhu Rongji, who was elected the president of the Tsinghua student union in 1951, and served as the Premier of the State Council from 1997 to 2001, a representative of the "red engineers" governing China (Andreas 2009) and serving the rapid development of China' industry. Some of the early faculties moved to the United State, for instance Y. H. Ku continued his academic life at University of Pennsylvania and Yuk-Wing Lee returned to MIT, after the People's Republic of China was founded in 1949.

While the early ten Tsinghua presidents during this period all received degrees from the United State, Y. C. Mei, serving as president from 1931-1948, became one of the most memorized presidents throughout Tsinghua's 110 years of history. Before returning to China as a physics professor and later the provost at Tsinghua since 1915, Y. C. Mei studied in the United State from 1909 to 1914, receiving a degree in Electrical Engineering from Worcester Polytechnic Institute. President Mei was later awarded an honorary doctoral degree from Worcester Polytechnic Institute in 1941, in honor of his great contribution and encouragement to Chinese higher education during the most difficult time of the world war II.

MIT was the chief international partner of Tsinghua during this phase. However, Tsinghua's partners were not limited to American institutions like MIT, but also included European scholars and higher education institutions – providing Tsinghua with a diverse international academic cooperation network. French physicist Paul Langevin visited and lectured at Tsinghua in winter 1931 as a member of the League of Nations delegation to China. French Mathematician Jacques Hadamard arrived at the beginning of the spring term of 1936 as a three-month visiting professor in the Mathematics department – he and Norbert Weiner had a good chance to meet each other at Tsinghua in that spring. Niels Bohr, the Danish Nobel Laureate of 1922, lectured at Tsinghua in 1937. P.A.M. Dirac, the British Nobel Laureate of 1933, gave lectures at Tsinghua in summer 1937. Apart from the faculty cooperation, the exchange student programs with some German universities such as Eberhard Karls Universität Tubingen, Georg-August-University of Göttingen, Karlsruher Institut für Technologie, had been sustained in the 1930s.

Phase two (1949-1978): Turning to the Soviet Union

The sources of international influence on China's and Tsinghua's higher education underwent a drastic shift shortly after the founding of the People's Republic in 1949. Understanding this shift necessitates considerations of the political, economic, and cultural conditions facing the nascent Communist regime. Politically, the United States cut ties with the Communist China, pushing the latter toward a more resolute engagement with the socialist camp spearheaded by the Soviet Union. Although the honey-moon of Sino-Soviet relations only continued less than one decade after 1949, its impact on higher education has been long lasting.

The cultural implications of adopting the Soviet model of higher education were more subtle, however. Although the Soviet Union was considered the East pole in the East-West divide in political terms, as Hayhoe (1996) notes, for China the Soviet Union was yet still a representation of the "Western culture." In particular, the Soviet model of education, influenced to a great extent by the French tradition, stood in sharp contrast to the classic educational tradition inherited from the late imperial China, and differed from the American education system that had been transplanted to China. An important feature of the Soviet model of education was its intensive degree of rationalization (of curriculum, teaching staff, etc.), which posed a striking contrast to the much more spontaneous and flexible "*shu yuan*" (academy) culture in traditional Chinese education, a culture that had to date encountered less shock from the relatively open-ended Anglo tradition of liberal education. Scholars have different assessment of the very scope of Soviet influence on China's higher education during the earlier years of the People's Republic, they nonetheless agree that the Soviet presence was extensive and significant. Yang (2000, p.327) speaks of this era as "one hundred percent" adoption of the Soviet model. Andreas (2009) specifically notes the impacts of the Soviet Union on Chinese higher education in four areas: teaching methods, exams, curriculum, and learning materials. Cao (1998) assesses the impacts of the Soviet emphasis on centralization and hierarchy on the development of university teachers in China. Hayhoe (1996) cites the restructuring of the university curriculum as an indicator of the rationalization of student learning under the Soviet influence.

To achieve a robust understanding of the comprehensive Soviet transformation of China's higher education, particularly the transformation of its engineering education, it is important to take note of the feeble foundation of the national industry and the extreme shortage in engineering and technical workforce during this period of time. In 1951, the total number of freshmen enrollment in engineering majors was 17,689, a number far shorter of the need of engineers and technicians for the nation's industrialization strategy (Jiang and Wang 2019). The Soviet Union's experience of fast industrialization contributed in important ways to the appeal of its higher education system – if the American engineering education could be considered as a primary model for producing professional engineers, the soviet system targets more at qualified technical human resources, with regarding to the scale and speed of engineering training.

Following the central government's call for "learning from the Soviet Union," Tsinghua entered an era of close engagement with experts from Soviet Union and other socialist nations in East Europe, such as the German Democratic Republic (Wang 2003; Bao 2008; Yin et al. 2011). Once again, historians differ in their calculations of the exact period of this close engagement, but the years between 1952 and 1960 fall into most historians' calculations. By the official account of Tsinghua University, over 60 experts from the Soviet Union, German Democratic Republic, and Czech (referred to as "Soviet experts" for brevity hereafter) worked at Tsinghua between 1952 and 1960. Together these visiting experts taught 114 courses, helped build or expand 72 laboratories, and trained 518 faculty members at Tsinghua as well as a total of over 4,000 technical experts in China (Yin et al. 2011).

A national decree for the "reordering of colleges and departments," implemented between 1951 and 1953, paved the way for the Soviet reconstruction of engineering education at Tsinghua. Under this decree, departments of humanities, social sciences, and several natural sciences were moved out of Tsinghua to be merged into other institutions of higher education – there were only about 100 engineering faculty members left in 1952, while new engineering departments were created or moved into Tsinghua from institutions with more limited faculty and laboratory equipment. The end result of this reordering was the conversion of Tsinghua from a comprehensive institution of liberal education into a poly-technical university that focused exclusively on producing engineers and technical teachers (Hayhoe 1996). This formal restructuring laid the foundation for the further rationalization of teaching and learning at Tsinghua under the advisory of the Soviet experts.

Specifically, the footprint of the Soviet experts at Tsinghua were most strongly perceived in three main areas: organization, education, and research. First, the Soviet experts advised the reorganization of teaching and learning at Tsinghua. The visiting experts worked with Tsinghua administrators and faculty members to create dozens of "specializations"—programs of undergraduate study, which shared a common curricular structure consisting of four parts: "common courses (politics, foreign languages, physical education), basic theory courses, specialist theory courses, and specialist courses" (Hayhoe, 1996). On the teaching side, the department, previously the basic organizational unit for faculty members, was replaced with the mechanism of "*jiao yan zu*" (group of teaching studies), an import from the Soviet Union that organized faculty members by areas of teaching so as to form a community of teaching practice. Besides advising the university's organizational restructuring, the Soviet experts also engaged deeply in the day-to-day aspects of education. A major change at the beginning of this period was the extension of undergraduate study at Tsinghua from four to five years. The Soviet experts participated in creating the curriculum for each specialization (major) in accordance with the new five-year program. Also thanked to the suggestions of the Soviet experts, the "productive practicum"—short periods of visits and work in factories and construction sites—was institutionalized as a part of the curriculum. Faced with shortages of course syllabi, the foreign experts worked with Chinese colleagues to translate syllabi used in Soviet universities into Chinese, and some of them played an active role in designing new courses. The courses taught by the Soviet experts were offered primarily to Tsinghua faculty members and senior level students. In many cases the young teachers at Tsinghua attended accelerated classes taught by the Soviet experts and completed all the course assignments before stepping on the podium to teach the same courses to students. Besides teaching, the Soviet experts spent a significant portion of their time developing teaching materials and textbooks, which resulted in the publication of dozens of textbooks in Chinese. Finally, the Soviet experts advised Tsinghua leaders in reviving the university's research capacity, which had been in a halted status during the early 1950s. Soviet scientists and engineers participated in committees and meetings that developed strategies in different areas of research. Furthermore, a number of Soviet experts collaborated with Tsinghua faculty and students in building laboratories and libraries, and in the design and conducting of research experiments.

Compare to the limited numbers of elite American and European professors who had visited and lectured at Tsinghua between 1911 and 1949, the number of Soviet experts and the scope of their collective work at Tsinghua were very distinctive. If Phase one witnessed Tsinghua's transplantation of foreign engineering education primarily according to the university's own will and anticipation, the international engagement in Phase two exhibited a more comprehensive execution of centralized higher education plan of the state. The soviet education system was more thoroughly and directly transplanted than the American system in the previous phase– the credit system was abandoned, and textbooks and teaching methods were switched to match the Soviet style. Yet the majority of the Tsinghua faculty during this period had not been educated under the Soviet system – of the total 206 faculty members (78 professors and 128 associate professors) in 1965 (170 in engineering), most full professors were trained in the United States or Europe, while most associate professors had been educated domestically. Only a limited number of faculty member received education from the Soviet Union – sending more students to study in the Soviet Union was suspended due to the sudden breaking of Sino-Soviet alliance in 1960.

Under the Soviet system, the university's research function was largely moved out to the Chinese Academy of Science. Tsinghua University, as with other Chinese universities, focused on undergraduate engineering education programs, naming itself "the cradle of red engineers".

Phase Three (1978-2020): **Restoring International engagement and Launching the Global Strategy**

Phase three examines Tsinghua's international engagement in the era of the national "opening up" policy, beginning in the late 1970s. This stage witnessed not only the restoration of Tsinghua's departments of mathematics, physics, chemistry, law, humanities, social sciences and medicine, but also the expansion of its engineering education (in 2012, the university employed 3003 faculty members, among whom 1755 were employed in engineering). The legacy of eight years' emulation of the Soviet Union education system has been somewhat sustained in teaching, while the credit system and research were restored, and a graduate school set up in 1984. More importantly, booming academic exchanges between Tsinghua and a broad variety of countries and regions in the world have broadened and deepened the international engagement of engineering education.

The restoration and transformation of international engagement during Phase three can be traced first through Tsinghua's university leadership. Five of Tsinghua's seven presidents during this period had international education experiences. Jingde Gao, Tsinghua president 1983-1988, earned his Ph.D. in electrical engineering from Peter the Great Saint-Petersburg Polytechnic University in 1956 - the first Chinese Ph.D. from the Soviet Union. Xiaowen Zhang, Tsinghua president 1988-1994, spent one academic year at Lehigh university and U. C. Berkeley from 1983 to1984. Dazhong Wang, Tsinghua president 1994-2003, a nuclear engineer, earned his Ph.D. from Rheinisch-Westfaelische Technische Hochschule Aache, Germany, in 1982. Binglin Gu, Tsinghua president 2003-2012, earned his Ph. D in physics from Aarhus University, Denmark in 1982. Jining Chen, Tsinghua president 2012-2015, received Ph.D. degree in civil engineering from Imperial College London in 1992. The current Tsinghua President (2015-) Yong Qiu is the first one to have received his entire higher education (BA and Ph.D. in chemistry) at Tsinghua. The education of Tsinghu University leadership could be considered as a metaphor – from international to interdependence.

Besides the university presidents, more and more Tsinghua faculty members have received international education. Tsinghua began to experiment with the tenure track system and to recruit international faculty since the 1990s. When the Department of Industrial Engineering was established with fourteen faculty members in 2001, Dr. Gavriel Salvendy, Professor of Industrial Engineering at Purdue University and a member of the United States National Academy of Engineering, was appointed chair professor and founding department head – who went on to become the first foreign dean in Tsinghua's history. School of Information Science and Technology invited 12 honorary professors from 11 universities and institutions abroad – mostly from the United State and Japan. In addition, 23 distinguished visiting professors from 22 international universities and research institutions were appointed by the same School. In 2004, Tsinghua jointly hosted the 3rd ASEE International Colloquium on Engineering Education with

Chinese Academy of Engineering, National Natural Science Foundation, and the American Society of Engineering Education. The four-day colloquium covered topics such as continuing education and its delivery, engineering education reform, and international recognition of qualifications. Over 300 representatives from domestic and foreign institutions attended the colloquium. In 2016, jointly with Chinese Academy of Engineering, Tsinghua set up the International Centre for Engineering Education under the Auspices of UNESCO, which has built a close network with global engineering education communities.

Phase three witnesses a much more diversified and large-scale internationalization at Tsinghua beyond simply transplanting the Western or Soviet model. From 2015 to 2018, Tsinghua led the world in the number of publications in both engineering, physical science, mathematics and computer science. Of the top one percent of the most frequently cited papers in the physical sciences and engineering, Tsinghua faculty authored the third most papers, lagging 41 behind only MIT and Stanford in the same period. (CWTS Leiden Ranking, 2020) Tsinghua ranked 1st in engineering by the 2021 U.S. News and and 9th by QS subject rankings. By 2020, Tsinghua has established eight engineering schools - architecture, civil engineering, environment, mechanical engineering, aerospace engineering, information science and technology, material science, nuclear and new energy technology - and the long outstanding Department of Electrical Engineer of Tsinghua still exists.

With strong support from the university president, backed by high speed economic development in China during the past four decades, Tsinghua launched its first global strategy in 2016. The past five years have seen the impact of Tsinghua's global strategy. Groups of students and faculty members were sent abroad, more and more international joint-projects were conducted, thousands of international students have been admitted to study at Tsinghua. In 2018, L. Rafael Reif, MIT President, Robert B. Millard, Chairman of the MIT Board and the MIT delegation visited Tsinghua University. The two universities celebrated their long history of friendship and extensive cooperation in the fields of computer science, architecture, engineering, medicine, and climate change. Based on the cooperation with Pontifical Catholic University of Chile, Tsinghua set up a Latin American Research Centre in 2018. A Centre for Russia Studies was set up at Tsinghua, with support from St Petersburg University in 2019. During phase three, the Tsinghua-Berkeley Institute was built in China and later upgraded to Tsinghua Graduate School in Shenzhen. Global Innovation Institute (GIX) was established in Seattle through partnership with Washington University and Microsoft. A Design School in Milan, Italy was established jointly with Milano Technical University.

To date, Tsinghua has signed institutional agreements with nearly 300 higher education institutions worldwide, set up over 20 student exchange programs at the university level, and more than 4,000 international students from 133 countries are studying on Tsinghua campus. Much though the COVID-19 pandemic is still challenging, Tsinghua sustained cooperation with most of its international partners – it organized an online Sino-US university president forum and a global university presidents forum, renewed several agreements and, received hundreds of exchange students from Cornell University, Carnegie Mellon University and Parsons School of Design at The New School. The international engagement of engineering education is enhanced as Tsinghua continues to pursue its goal of becoming a leading international university.

Conclusion

Knowledge of engineering education has been distributing and spreading through cooperation among scholars across geographical boarders, across generations and even centuries. Such an effective network of knowledge dissemination contributes in important ways to narrowing the gaps among regions and nations of engineering education and offers strong support for global industry development through qualified engineering human resources. The past century witnessed the birth, development, and maturing of engineering education in China. The case of Tsinghua shows that international engagement is not only deeply rooted in the origin of China's engineering education; it also profoundly shapes the present engineering education system in China. Notwithstanding political turbulences and interruptions to international engineering education cooperation during the wartime, the tradition of international engagement proved to be strong and robust.

The COVID-19 pandemic has changed the pace of globalization and disrupted the expansion of global higher education. The tensions between the United States and China also cast many uncertainties over the future of international exchange and collaboration in engineering education. Yet, the engineering community has demonstrated its own approaches and logics in sustain academic cooperation, which are at times different from the approaches and logics that drive international relations and national politics. "One can anticipate with the globalization of the university through the World Wide Web, a new type of intellectual who will be global and thus not committed to any particular national system. Richard Rorty's notion of irony may well come to adequately describe the mental outlook of such global intellectuals."(Turne, 1998) This prediction might be too encouraging, yet existing global challenges like the pandemic and climate change do call onto engineers to engage in—not shun away from—global cooperation. To prepare our best engineers to tackle these global challenges, engineering education community needs to further push for academic cooperation. Tsinghua's ongoing efforts of renewing its global strategy – possibly the global strategy 2.0 – indicates its continuous commitment to the global community of engineering education.

Acknowledgements

This study is supported by the Engineering Education 111 Project (B20073).

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